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ABSTRACT

This paper explores the interactions between preservice and inservice teachers in a non-school setting as a part of the EarthVision 2000 project. The involvement of inservice teachers in teacher education plays an important role in the knowledge of field experiences. Creating a program for the initial preparation of preservice teachers for effective teaching has been a challenge for educators. With the implementation of EarthVision materials and development--a partnership between preservice and inservice teachers--the goal was to improve the quality of preservice teacher education. This study explores whether the selected seven high school science teachers and one high school mathematics teacher benefited from the early collaboration with inservice teachers. (Contains 15 references.) (YDS)

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by
Anita Greenwood

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Preservice and Inservice Science Teachers in Partnership Through EarthVision 2000

Anita Greenwood, Ed.D.

Introduction

The importance of inservice teacher involvement in teacher preparation programs is widely acknowledged (Mason, 1989; Winitsky, Stoddart & OiKeefe, 1992). Such involvement, has generally been targeted at a variety of field experiences which are designed to provide a link between theory and practice Yager (1990) indicates how important it is for teacher education faculty to understand the philosophy, style and actions of the inservice teachers who will be involved in teacher education programs. Without this knowledge field experiences may serve merely to induct preservice teachers into routinized norms of common practice (Zeichner, 1980). Much has been written about the role of teachers as a mechanism for socialization of new teachers (Feiman-Nemser & Buchmann, 1986; Zeicher, 1980), but our understanding has generally come from the experiences of preservice teachers while in field placements where other variables such as the culture of the school are influential. This paper explores the interactions between inservice and preservice teachers in a non-school setting, when both were enrolled in a summer institute as part of the EarthVision 2000 project. The researcher hoped to gain insights into the influence that inservice teachersí pedagogical perspectives have on preservice teachersi thinking as well as the effects of developing partnerships between preservice and inservice teachers on the ensuing prepracticum.

Field Experiences and Professional Partnerships

Since the 1980s, when Shulman (1987) described the role of subject knowledge and pedagogical content knowledge in learning to teach, there has been debate over when and how preservice teachers might be furnished with such knowledge (Hollingsworth, 1989). For many years, teacher education has sought to find the balance between learning to teach through course work and through experience. Early field experiences (sometimes known as prepractica) are considered to be an integral part of any preservice teacher preparation. They are designed to expose students to the world of practice and create a bridge to course work (Russell, 1988). Further, they potentially provide a time for experimentation under the guiding eye of a mentor teacher. But the reality of the early field experience can fall far from its goal. In high schools in particular, the early field experience often takes the form of a weekly visit to a department, where, although the preservice teacher is welcomed, their time is mostly spent in observation, with little opportunity to discuss or question practice (Feiman-Nemser & Buchmann, 1986). There are few chances to prepare and lead lessons because teachers do not know the preservice teacheris abilities, neither are they able to estimate where the course content will be when the preservice teacher next visits.

Although preservice teachers enjoy school visits, from a methods instructoris perspective they often represent wasted opportunity. Preservice teachers lack the ability to analyze the lessons they observe and the confidence to question teachersí decision-making and actions. Similarly, experienced teachers although excellent within the context of classroom teaching, may be unable to articulate what they do and why they do it (Feiman-Nemser & Buchmann, 1987). The challenge for teacher educators therefore is:

> Ö to create programs of initial preparation that develop the beginneris inclination and capacity to engage in the sort of intellectual dialogue and principled action required for effective teaching (Barnes, p. 17, 1989).

In the late 1980s, the frustration with prepracticum experiences was addressed in the move toward professional development schools (The Holmes Group, 1990) where it was hoped that teachers would play an important role in teacher preparation. However, although elementary and middle schools commonly report collaborative links with colleges, in high schools, the demands of the curriculum and the inability of Colleges of Education to provide sufficient remuneration for teacher involvement, have often resulted in lip-service only being paid to the joint involvement of high schools and colleges in teacher preparation (Lawson, 1990). Some successful examples of collaboration between high school teachers and colleges of education do exist. Schoon and Sandovalis (1997) Urban Teacher Education Program (UTEP), integrally involved teachers in urban schools in developing the field components of the program, creating a seamless field experience model which carried the preservice teachers from the prepracticum into the practicum. Mason (1989) reported on the benefits of a triad model in teacher preparation which involved university content specialists, education faculty and high school teachers.

In response to the call for national reform in teacher preparation, UMass Lowell (then ULowell) made the commitment to becoming an all graduate program, concentrating the development of pedagogical content knowledge into a one-year, post-baccalaureate, intensive program or a two-year part-time program.

The program retained its early field experience, sending preservice teachers on weekly visits to high schools. Each preservice science student spent 4 visits in a chosen suburban school, 4 visits in an urban school and 4 visits in the proposed practicum site. Never the less, we continued to find that preservice teachers were still merely observers in classrooms, or at best, assistants during lab periods.

With this in mind, the researcher sought to develop a forum which might bring together preservice and inservice high school science teachers prior to the prepracticum in order to develop professional partnerships which might change the face of the ensuing prepracticum. Simmons (1994) has shown the value of involving preservice teachers in settings such as professional conferences, where they have the opportunity to share their perspectives on teaching and learning with experienced practitioners. In this study, preservice and inservice teachers were brought

SE063917

together in a summer institute held at UMass Lowell. The institute was part of EarthVision 2000, a project funded by the US Environmental Protection Agency, and provided the setting to explore the research questions guiding this study, namely:

How do inservice teachersí pedagogical perspectives influence preservice teachersí thinking in a non-school setting?

What is the effect of developing inservice-preservice teacher partnerships in non-school settings on the ensuing prepracticum?

Background to the EarthVision 2000 Project

In 1998, a collaborative effort by Ohio State University and the University of Massachusetts Lowell, funded by the Environmental Protection Agency, sought to introduce mathematical modeling and computer visualization into regular high school science classrooms. The goal of the project at the classroom level was two-fold (I) to involve students in real environmental research, identifying a problem of local concern and modeling it; and (II) to help students to recognize the integral relationship between mathematics and science. Teachers in Ohio, Michigan and New England participated in the project. In New England, there was an additional goal directed at improving preservice teacher education through the formation of partnerships between preservice and inservice teachers in order to implement EarthVision 2000 materials and to improve the quality of preservice teacher prepracticum experiences.

The New England teachers who agreed to participate in the project all had ecosystem studies in their curriculum. They asked the faculty at UMass Lowell to develop a mathematical model to be used with their existing curricula. As a result, an ëAir Qualityí model was designed to show the flow of gaseous contaminants in air from a point source to a receptor site i.e. the ecosystems studied in the schools. The flow was visualized through use of a program created specifically for the participating schools, using Mathematica®.

Subjects and Settings

This non-experimental, field-based research occurred during the two-week summer institute and the subsequent fall semester. Participants in the study were seven high school science teachers and one high school mathematics teacher from five different high schools. The researcher (in the capacity of a methods instructor and practicum supervisor) knew three of the teachers. One had worked with many preservice teachers from UML in the past, while the other two had worked with one UML student. Five of the inservice teachers had more than fifteen years of teaching experience, while the other three had from one to six years of experience.

Additionally, eight graduate level, preservice science teachers were enrolled in EarthVision 2000 as an elective course in a one-year intensive graduate education program. None had taken a science methods course and were to embark on this and the prepracticum in the fall semester following the institute. Three of the preservice teachers had some experience as substitute teachers, but the other five had not worked or observed in schools in any capacity since their own high school days. Five of the preservice teachers had made a career change, moving from industry to teaching.

At the beginning of the summer institute, each preservice teacher was paired with one of the teachers (resulting in eight pairs) based upon content knowledge and geographical location of the preservice teacherís home with relationship to a participating high school. Biology and Earth Science preservice teachers were paired with Physics or Chemistry teachers and vice versa. In this way each pair had a complement of life science and physical science or math content knowledge. The purpose of this pairing was for the preservice and inservice teachers to become equal partners in preparing to implement EarthVision 2000 materials in classrooms and for the ensuing prepracticum to be designed around co-teaching EarthVision 2000. None of the teachers and only one of the preservice teachers had experienced previous instruction in modeling and visualization.

Summer Institute

The summer "EarthVision 2000" institute took the form of two weeks of full-time instruction when inservice and preservice teachers learned: (a) about the nature and use of mathematical models in science; (b) how the air quality model is derived; (c) the use of spread sheets for model computation; (d) simple programming commands in Mathematica®; and (d) manipulation of the air quality Mathematica® program. Additionally, two days were devoted to discussion and curriculum planning. Implementation of learning was to begin either in the fall or spring semester depending on each schoolís curriculum sequence.

Fall Semester

The fall semester represented the beginning of curriculum implementation, as well as the prepracticum period for preservice teachers consisting of twelve visits. Preservice teachers were to visit at least two EarthVision 2000 schools, for a total of 5 visits, as well as having the option of returning to an EarthVision 2000 school as a potential practicum placement site.

Data Collection

In order to ascertain whether preservice teachers benefited from their early collaboration with inservice teachers a variety of data sources were used, such as observation, interviews, reflective journals and questionnaires. Daily feedback forms were completed as well as an initial and end-of-institute questionnaire. Additionally, preservice teachers maintained a daily reflective journal, which they summarized at the end of the institute in order to provide a narrative of the value of the partnership to them. Inservice teachers wrote a final description of their plans for continuing the partnership during the fall semester prepracticum.

Data collected during the fall semester from the preservice teachers were in the form of notes taken by the researcher during prepracticum observations and during classroom-based discussions with preservice teachers. Inservice teachers provided feedback to the researcher in the form of email communications.

Data Analysis

Summer Institute

Analysis of the data indicated that all participants gained from the partnering of pre and inservice teachers during the summer institute. However, certain partnerships emerged stronger than others did and this was reflected in the success of the ensuing prepracticum.

Initial perspectives of inservice and preservice teachers ñ Day 1

On the first day of the institute, the participants were asked to respond to two questions:

1. How much time in a science course would you devote to expository instruction and how much to guided discovery and inquiry?
2. In a science course, what emphasis would you put on developing science concepts, inquiry skills, critical thinking, and an understanding of the nature of science?

In response to the first question, there was very little difference between the responses of the preservice and inservice teachers. Both groups indicating that expository teaching should be the main approach to teaching science (see table 1 below).

	% of time allocated in a science course to:		
	Expository teaching	Guided Discovery	Autonomous Inquiry
Preservice (N=7)	42	31	26
Inservice (N=8)	46	28	20

Table 1 ñ Percentage of a science course devoted to each different teaching strategy

With regard to the second question, the content of science courses, five preservice teachers indicated that they would give approximately equal emphasis to teaching concepts, inquiry skills, critical thinking and understanding the nature of science. The remaining three preservice teachers indicated a slightly higher emphasis on teaching concepts. All inservice teachers except one, gave considerably more emphasis to the teaching of specific concepts.

The preservice teachers were also asked what they expected their role to be during the fall prepracticum when working with an EarthVision (EV) teacher. All but one preservice teacher stated that they saw themselves assisting students and being a co-expert in the classroom. One preservice teacher indicated that his/her role would be as a ëgo-ferí setting up equipment and collecting papers.

Developing Partnerships

Initially, inservice teachers felt more at ease with the partnership arrangements than did the preservice teachers, but by day three of the institute both preservice and inservice teachers were reporting high levels of comfort with working with their partner. The daily feedback forms and end-of-institute questionnaire provided vital insight into preservice and inservice teachersí learning from the experience. Comments clearly indicated that preservice teachersí perceptions of teaching changed as a result of the EarthVision experience. Their daily discussions with the inservice teachers seemed to surprise, but also enlighten them about the demands of their chosen profession.

Preservice Teacher 1

[I am] somewhat surprised to hear that some teachers actually do use alternative methods of teaching instead of straight lecture.

Preservice Teacher 2

I realized what a hard job planning curriculum is. I didnít realize how much time went into everything.

Preservice Teacher 3

I feel that this is the start of an enlightenment about nuts and bolts of high school students and how to direct their learning.

Preservice Teacher 7

(EarthVision) has made me realize how hard it can be to plan curriculum and how difficult it is to fit everything into a constraining time period.

For the first seven days of the institute, the preservice and inservice teachers stayed together not only for the institute sessions, but also at lunch

times. The preservice teachers did not know one another very well at this point neither did the inservice teachers and thus there was little tendency for them to meet as separate groups. Preservice teachers were able to benefit from formal and informal interactions with their partners and commented upon their learning in their journals.

Preservice Teacher 6

Today I learned a great deal about student learning from two inservice teachers. Students do not always grasp the entire concept, but learn enough of the process to (create) an adequate impression on the teacherÖ a student can miss the whole point of the exercise if proper assessment is not completed. My interaction with in-service teachers enlightened me to the skills of sophomore high school students. According to the teachers, most students have difficulty with extrapolating information from a graph.

Preservice 4

Every teacher had different intentions for the use of Mathematica in their classroom and everyone had different understandings of how much this project required. This leads me to believe that mathematics will play as big a role in a science classroom as the science teacher wishes.

But as the institute progressed it was clear that some partnerships were working better than others. Days nine and ten of the institute were devoted to curriculum planning. For five partnerships this was a very productive period of sharing expertise as illustrated in the comment below. Here the use of the pronoun ëweí suggests that the preservice and inservice teacher thought the plans out together and felt co-ownership for the module they devised.

Preservice Teacher 4

Curriculum development discussions with my partner teacher revealed the confusion that she felt about how math would fit into her science class. However, when we finally thought through what we wanted to get out of EarthVision, how it will be useful with pre-existing curricula, the use of mathematical modeling actually became exciting. It took the planning before we could understand or even think about the math and modeling part. Suddenly the use of math fell into place and we all could see how useful it would be.

The developing collegiality was also expressed by another preservice teacher:

The inservice teachers gave the realistic constraints of planning the curriculum which helped us help them to build the EarthVision curriculum.

However, it was the curriculum planning that caused the disintegration of three of the partnerships, leaving the preservice teachers feeling as though they could not contribute. One commented about day nine that heÖ

"Spent the morning doing curriculum planning, had a difficult time with this. I find it hard to set up an inquiry class and curriculum. I didnít do much. The ërealí teachers did it themselves."

While another stated that "my teacher went off by himself to plan so I couldnít get into the planning process like other preservice teachers." None of the inservice teachers commented on partnership problems.

Final perspectives of inservice and preservice teachers ñ Day 10

The final feedback form on the last day of the institute, asked inservice teachers to comment on the inclusion of preservice teachers in the project and the role that they would play during the prepracticum. All teachers commented to the effect that they felt that preservice teachers had benefited from gaining insight into the realities of the classroom from their discussion with experienced teachers.

Inservice Teacher 1

The more exposure to the realities of the classroom, the better prepared a new teacher will be.

Inservice Teacher 2

It has helped them to see "how" teachers think and problem solve. Additionally, how one must think of how students will react.

Three of the inservice teachers also stated that they believed that experienced teachers gained from the interactions, although no comments were made by the inservice teachers that reported or reflected on the nature of the discussions they had had with the preservice teachers. One inservice teacher, commented that:

Inservice Teacher 3

It was great to have their (preservice teachers) questions or to have to explain when they didnít understand. For them to be able to see the implementation of something like this with its many components (math, science and technology) in the actual classroom should be very beneficial. We need people like them to encourage and inspire us.

The preservice teachersí responses were somewhat more focused on the discussions that had occurred. They commented on what they had learned about the limitations of resources in schools; the difficulties of planning collaboratively and the time that planning takes. However, most comments reflected preservice teachersí concerns with teachersí attitudes to teaching and the frustrations that teachers expressed. This is best expressed in the following two comments:

It has been very interesting to be exposed to the different philosophies and attitudes of inservice teachers. They are a sort of reality check of what is to be expected and possibleÖI was sort of surprised at the frustration/negative attitude. Some seem very dedicated, but almost all seem to have a huge sense of frustration.

It is good to see that "teachers are people too." They have strengths and weaknesses and the best teachers seem to be those that make the most of

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their strengths and arenít hindered by their weaknesses.

Fall Prepracticum

The fall prepracticum was structured into four phases with a total of twelve full-day visits to schools as shown in table 2. Between the summer institute and fall semester, one preservice teacher left the program, gaining employment in a school and embarking on an alternative route to certification. Consequently, only seven partnerships remained as the prepracticum began.

For the first five prepracticum visits (phases 1 and 2), preservice teachers went to the schools of EarthVision 2000 partner teachers. As might have been expected from the partnerships that developed in the summer institute, not all of the prepractica were successful. In three of the five schools the preservice teachers were immediately made welcome. Two of the schools, launched almost immediately into an aspect of EarthVision 2000 work, so they drew upon the knowledge that they knew the preservice teachers possessed and involved them in the teaching and planning.

Prepracticum Phase	Preservice Teacher Placement
One: 3 visits	With EarthVision 2000 partner
Two: 2 visits	With another EarthVision 2000 school
Three: 4 visits	With other EarthVision schools or Non-EarthVision schools
Four: 3 visits	At potential practicum site

Table 2 - The phases of the prepracticum experience

In particular, preservice teachers were integral in helping the teachers to conduct field-work, an opportunity which had never before occurred during a prepracticum (other than in the capacity of a chaperone!). In both schools the preservice teachers spent a whole day at a local field site with tenth and eleventh grade students, manning stations for water analysis and organism identification and engaging in small group teaching. They gained insights into the challenges of conducting field work that could not have been achieved through mere discussion in methods class.

In the three cases where professional partnerships had not developed, the teachers were not sure what to do with the preservice teachers and consequently assigned them to observation. Furthermore, the complexity of the EarthVision 2000 project led the other three schools to defer implementation until the spring. Consequently, the prepracticum visits to schools became the same observation-only experiences that the project had hoped to change.

In phase 3, the preservice teachers devoted 4 visits to two more schools. No preservice teacher opted to visit a third EarthVision school. None of the visits in phase 3 involved preservice teachers in teaching, although many assisted in small group work.

The final phase placed the preservice teachers in their potential practicum site. This site was decided on by the methods instructor (who was also the researcher) and the student. Only two of the seven preservice teachers chose to work in an EarthVision school, and in fact one of these did not work with the EarthVision teacher in that school. In the second case the preservice teacher who chose to work with an EarthVision teacher was not the original partner. That no preservice teacher chose his/her EarthVision partner for the practicum placement was not totally unexpected as the partners had been paired across science disciplines (i.e. biologists had been paired with physicists or chemists). However, that only two of the five EarthVision schools became practicum sites was disappointing.

Discussion

This paper sought to explore how inservice teachersí perspectives influence preservice teachersí thinking and the effects of inservice-preservice teacher partnerships on an ensuing prepracticum. From the analysis of the summer institute data, it seems clear that the ëtaste of realityí provided by inservice teachers was only valuable when enthusiasm for teaching outweighed frustration. In five of the eight partnerships, preservice teachers recognized that their partners had an underlying view of teaching as worthy, but complicated work. These partnerships were fruitful. However, three preservice teachers felt that their partners were more concerned with the difficulties of teaching and of being a teacher.

The data from the institute also indicate that for professional partnerships to develop successfully two factors are crucial: (I) that both individuals contribute a strength or skill; and (II) that working styles and personalities fit (not necessarily match). The summer institute provided the setting for identifying the strengths and styles of each partner that might not have been discovered in a normal prepracticum arrangement.

On the whole, the strengths contributed by preservice teachers related to their greater familiarity with computers, including spreadsheet use and general programming skills. This strength facilitated the learning of Air Quality Model and Mathematica. Additionally, most of the preservice teachers were career-change individuals who brought a perspective on the application of science and mathematics knowledge in industrial settings to the partnerships. The inservice teachers naturally had greater expertise in curriculum planning and had more extensive curriculum content knowledge, as well as knowledge of the appropriateness of institute materials for high school students. Each turned to his/her partner for guidance according to the demands of the task.

When the strengths of individuals in the three less successful partnerships were examined it was found that the three preservice teachers had the least computer experience, although one had exceptional mathematics skills. Two of the preservice teachers had no work experience. Similarly, two of the inservice teachers had less curriculum knowledge. Unfortunately, these factors were unknown when the pairings were made and by chance these pre and inservice teachers were brought together.

Weaknesses in partnerships might have been overcome if personalities and working styles had fit. Observations of the pairs throughout the summer institute clearly indicated that unsuccessful partnerships also experienced problems in this area. Over-anxious and insecure preservice teachers placed with teachers who were not detail-oriented proved to be a recipe for disaster. Similarly partnerships where both individuals were shy and uncertain or where there was little flexibility on either or both sides, resulted in failure. In successful professional partnerships, teachers were confident, but open to preservice teachersi questions and were able to explain the rationale behind their thinking. These teachers also drew upon the experiences that the preservice teachers brought to the partnerships and treated them as colleagues. Preservice teachers responded by expressing their ideas without reticence.

Benefits of preservice-inservice teacher partnerships

Bringing preservice and inservice teachers together prior to the prepracticum did lead to better quality prepracticum experiences, and greater involvement in the science department as a whole, but only in those schools where EarthVision was being implemented. First, the opportunity to teach small groups of students during the field-work was the primary benefit, but this in turn led to a better understanding of the preparation needed before field-work can occur and the form that follow-up lessons must take. Second, all preservice teachers were required to interview teachers about aspects of teaching and learning during the prepracticum and those in a successful partnership felt better able to ask questions of their partner and probe for explanations. Third, the difficulties experienced by all partnerships when embarking on curriculum planning also proved to be of benefit, because this provided a point of reference for discussion and unit planning in both science methods and in the interdisciplinary methods class.

Implications

Socialization of teachers is the process by which new teachers become active participants in the profession (Zeichner & Gore, 1990). Research has shown how influential field experiences are in this process. Simmons (1994) however, claims that socialization should occur prior to student teaching. Her research showed the benefits of involving preservice teachers in professional conferences as a means of developing a stronger professional identity and maintaining enthusiasm for science education.

The EarthVision 2000 project also began the early socialization of teachers through the involvement of preservice teachers with inservice teachers in a summer institute. What is of interest from the findings reported here, is the rejection by preservice teachers of all views of ërealityí offered by inservice teachers. In this non-school setting, preservice teachers were much more likely to maintain their optimism about teaching. The reason for this lies in the fact that the summer institute brought together teachers from a variety of school districts involved in the same project. Preservice teachers could hear that what appeared impossible to one teacher was met with enthusiasm by another. Similarly, they witnessed how some teachers were able to overcome their frustrations and lack of resources through their own ingenuity and general enthusiasm. Clearly, the socialization of preservice teachers in a non-school setting where they witness and participate in an exchange of views among many teachers will be very different from socialization when placed with a single mentor.

The first implication of the study, therefore reinforces Simmonsí work (1994) in showing the importance of the involvement of preservice teachers with other professionals in non-school settings, where they are not so much viewed as less experienced novices as they are contributors to professional dialogues.

However, the effects of the partnerships on the prepracticum experience were not as marked. Only when there was a common experience i.e. in the schools where EarthVision was being implemented, were the preservice teachers involved in a meaningful way. The implication therefore is that inservice teachers must be fully involved in planning prepracticum experiences if they are to build in a role for preservice teachers who visit their classrooms.

This study has lent support to the call for changing the face of teacher education programs. As more and more teacher education institutions attract career change individuals and/or consider fifth year graduate programs for certification, they must move from traditional perspectives on preparation. Engaging preservice teachers and inservice teachers in professional settings other than field placements (e.g. summer institutes and conferences) seems to hold promise for developing the pedagogical insights needed for successful practice.

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